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NATIONAL DAM SAFETY PROGRAM. STRASBURG DAM (VA 17105), POTOMAC --ETC(U)
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POTOMAC RIVER BASIN

Name Of Dam: STRABURG *Dam*

Location: SHENANDOAH COUNTY, STATE OF VIRGINIA

Inventory Number: VA 17105

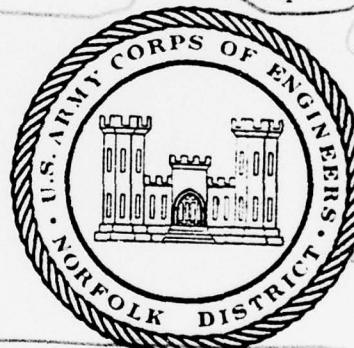
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LEVEL *IV*
PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Straburg Dam (Inventory Number (VA 17105), Potomac River Basin, Shenandoah County, State of Virginia. Phase I Inspection Report.



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10 Michael J Baker, III
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PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

AUGUST 1978

BY

MICHAEL BAKER, JR., INC.

BEAVER, PENNSYLVANIA 15009

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

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NAME OF DAM: STRASBURG

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Strasburg
State: Virginia
County: Shenandoah
Stream: Little Passage Creek
Date of Inspection: 1 June 1978

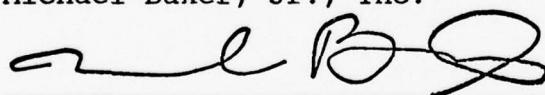
BRIEF ASSESSMENT OF DAM

Strasburg Dam is an earth dam approximately 37 feet high and 550 feet long, owned and operated by the Town of Strasburg.

The dam is classified as "small" size—"significant" hazard. The spillway passes the 100 year frequency storm, but the one-half Probable Maximum Flood overtops the embankment by 0.4 feet. No slope movements were observed; but a number of clear seeps indicate that the factor of safety against slope failure may be less than acceptable. It is recommended that:

- 1) Further investigation to assess embankment stability be made by obtaining and testing soil samples, and by installing piezometers to measure water levels in the embankment and foundation.
- 2) All clogged and damaged drains be repaired.
- 3) The existence of the buried three inch cast-iron pipe shown on the plan be investigated because it may be leaking reservoir water.
- 4) The clear seepage in the embankment and foundation be controlled by berms, filters and the extension of subdrains.
- 5) The owner perform a downstream flood analysis to determine the effects of a dam failure.
- 6) Tree growth be removed from the embankment.

Michael Baker, Jr., Inc.

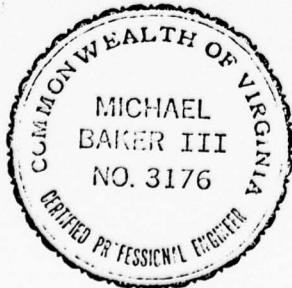


Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer

APPROVED:

Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: _____



NAME OF DAM: STRASBURG

OVERALL VIEW OF DAM

OVERALL VIEW OF DAM



PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: STRASBURG ID# VA 17105

SECTION 1 - PROJECT INFORMATION

1.1 General

- 1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.
- 1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

- 1.2.1 Description of Dam and Appurtenances: Strasburg Dam consists of an earth embankment approximately 37 feet high and 470 feet long. The present dam is a reconstruction of an earlier earth dam with a concrete core wall. Seepage control is provided by a clay core and drainage trench at the downstream toe of the clay core. An eight inch diameter open joint concrete pipe is used as an outlet for seeping water. The principal spillway consists of a concrete tower with slot-like cutouts that serve as overflow weirs. The outlet conduit is a 48 inch corrugated metal pipe with concrete collars which makes a transition to a 36 inch square concrete box conduit at the exit. The discharge is controlled by the outlet tower weirs and two (2) 12 inch valves. The dam is operated by the Town of Strasburg personnel. The emergency spillway is an uncontrolled earthen side channel.

The water supply system consists of a 12 inch slide gate in the intake tower, a 12 inch cast-iron control valve, and a 12 inch cast-iron pipe leading from the intake tower to an

NAME OF DAM: STRASBURG

eight inch waterline in a tunnel bored through Three Top Mountain. The eight inch line conducts water to the Town of Strasburg's storage and distribution system. Plates 1 and 3 illustrate the intake components.

- 1.2.2 Location: Strasburg Dam is located on Little Passage Creek approximately four and one-half miles upstream of its confluence with Passage Creek between Green Mountain and Three Top Mountain in Shenandoah County.
- 1.2.3 Size Classification: The maximum height of the dam is 37 feet. The reservoir volume to the crest is 119 acre-feet. Therefore, the dam is in the "small" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.
- 1.2.4 Hazard Classification: Due to the distance of eight miles to the Elizabeth Furnace Recreation Area and four miles to two farm dwellings at the end of Little Passage Creek, loss of life is possible in the event of failure of the dam. The height of the ground floor of the dwellings above Little Passage Creek is approximately 20 feet. Therefore, this dam is considered in the "significant" hazard category as defined by Section 2.1.2 of the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.
- 1.2.5 Ownership: The dam is owned by the Town of Strasburg.
- 1.2.6 Purpose of Dam: The dam is used for water supply for the town.
- 1.2.7 Design and Construction History: Strasburg Dam was originally built in the 1920's. The dam was constructed with a two feet thick concrete wall surrounded by earth fill. At that time, a tunnel was constructed through Three Top Mountain to carry water in a three inch cast-iron pipe to Strasburg. In 1954, the existing facility was designed for the owner by Wiley and Wilson Engineers of Lynchburg, Virginia. The dam was built by English Construction, Inc. beginning in 1955 as an enlargement to the existing earth dam with a concrete core wall. Construction was completed in 1955.

NAME OF DAM: STRASBURG

1.2.8 Normal Operational Procedures: Details of the dam's operation were not furnished by the owner or designer. Observations indicate that the normal water level is controlled by the primary spillway weir located at elevation 1404.0. A gate valve controls the entrance of water into the supply line.

1.3 Pertinent Data

1.3.1 Drainage Area: The drainage area of the Strasburg Dam is 0.89 square miles.

1.3.2 Discharge at Dam Site: The maximum known flow at the dam site through the emergency spillway is not known.

Principal Spillway:

Pool level at emergency						
spillway crest						5.5 c.f.s.
Pool level at top of dam						30.9 c.f.s.

Emergency Spillway:

Pool level at top of dam					1900	c.f.s.
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1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet M.S.L.	Area acres	Reservoir Capacity		
			Acre- feet(a)	Watershed inches(b)	Length miles
Top of dam	1411	7.03	89.1	1.88	0.21
Maximum pool, design surcharge	1411	7.03	89.1	1.88	0.21
Emergency spillway crest	1404.5	5.20	58.0	1.22	0.16
Principal spillway crest	1404.0	5.08	54.6	1.15	0.16
Streambed at center-line of dam	1375	0	0	0	0

(a) Based upon design figures, no correction for sediment.

(b) Based on 0.89 square miles of drainage area

SECTION 2 - ENGINEERING DATA

2.1 Design: The design data reviewed included the following:

- 1) Design drawings for the existing dam and alternate designs.
- 2) Calculations for the drainage area.
- 3) Approval of dam by U.S. Forest Service and State Department of Health.

2.2 Construction: Construction information reviewed included the following:

- 1) Excerpts from bid proposals for bids on different heights of the dam.
- 2) Proposal submitted by low bidder.
- 3) Letter regarding award of the contract.
- 4) Copy of contract.

2.3 Operation: Data on the operation of the dam, reservoir levels or spillway performance were not available.

2.4 Evaluation

2.4.1 Design: Design data was limited to the plans, drainage area calculations and regulatory agency approvals. The design alternate that was actually built in 1955 was sufficiently shown on the plans to provide a basis for the Phase I investigation.

2.4.2 Construction: Although construction progress reports and quality control records were not available, the bid and contract documents were helpful in evaluating the composition of the dam according to the constructed items.

2.4.3 Operation: Although a history of reservoir levels would be useful in evaluating the runoff characteristics of the small watershed, such information was not available. The remoteness of the dam makes the existence of operational records unlikely.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: The dam and its appurtenant structures were found to be in fair overall condition at the time of inspection. The problems noted during the visual inspection are considered important and do require observation. Noteworthy deficiencies observed are described briefly in the following paragraphs. The complete visual inspection check list is given in Appendix III.

3.1.2 Dam: The most noteworthy deficiency of the dam is the clear seepage at the bottom and right side of the structure. Four areas of clear seepage were noted:

- 1) An area 30 feet downstream of the toe of the embankment. Here clear seepage of one to two g.p.m. was outletting through the natural soil. Water was also flowing from the left subdrain outlet some 60 feet away showing that the subdrain was functional although partially submerged in iron precipitate slime and leaves (see Photo 1 in the Photograph Section).
- 2) At the position of an old three inch cast-iron pipe on the right side of the dam. The pipe was part of the original water supply system before the dam was enlarged. About 15 g.p.m. of clear seep is upwelling through the soil (see Photo 2).
- 3) At the embankment - left abutment contact below the downstream bench (less than one g.p.m.).
- 4) At the embankment - left abutment contact above the downstream bench (less than one g.p.m.).

The outlet for a surface drain on the right side of the concrete outlet conduit was also buried by tunnel entrance excavation (see Photo 3).

NAME OF DAM: STRASBURG

Although the downstream slope has been partially cleared, some small trees remain especially below bench level.

No unusual movement, misalignment, cracking, sloughing, or erosion was observed.

3.1.3 Appurtenant Structures:

- 1) Emergency Spillway: Some clear spring seepage from above the reservoir is flowing into the spillway channel, but no erosion or blockage was observed. The clear seepage was estimated at five g.p.m.
- 2) Inlet Tower: The concrete was chipped by the impact of bullets. Otherwise, the concrete appeared to be in good condition. The three feet square concrete outlet conduit and the 12 inch cast-iron water supply pipe inside of the conduit appear to be in good condition.

3.1.4 Reservoir Area: No unusual shoreline erosion or sloughing was observed.

3.1.5 Downstream Channel: The channel showed no evidence of excessive scouring.

3.2 Evaluation

3.2.1 Dam: The hydraulic head of water seeping at or beyond the toe of the embankment is 30 feet. To minimize the risk of a piping failure, a combination filter blanket and berm should be placed on the toe and beyond the point of farthest seepage from the toe. The surface and subdrain outlets should be extended through this proposed berm. Nevertheless, the right surface drain outlet has to be reconstructed. The existence of the possibly abandoned three inch cast-iron pipe should be investigated as well.

The clear seepage at the right abutment could possibly be spring fed from ground water in the hillside. However, a sand and gravel

NAME OF DAM: STRASBURG

filter at these locations will be a wise precaution against the possibility of the seeping originating at the reservoir.

The removal of small trees on the downstream slope should continue and will, in fact, be necessary if a filter berm is placed on the downstream toe.

- 3.2.2 Appurtenant Structures: Other than the patching of the bullet marks on the intake tower, the appurtenant structures observed need no remedial work.
- 3.2.3 Reservoir Area: The reservoir area does not require further investigation.
- 3.2.4 Downstream Channel: The downstream channel does not require further investigation.

SECTION 4 - OPERATIONAL PROCEDURES

- 4.1 Procedures: Operational procedures were not provided for this dam by the owners or designers.

There is no formal written procedure for emergency downstream evacuation in the event of impending catastrophe. However, the downstream area is sparsely populated. There are two farm dwellings near Little Passage Creek about four miles downstream of the dam and camp sites at the Elizabeth Furnace Recreation Area located about eight miles downstream on Passage Creek.

Rapid emergency drawdown is possible by operating the gate valve inside of the outlet tower. Consideration should be given to developing emergency operating procedures, even though, the remoteness of the dam will make the assessment of conditions difficult during, or immediately following, a storm.

- 4.2 Maintenance of Dam: The embankment has not been conscientiously maintained in the past as indicated by the destruction of the drain outlet and the untreated areas of clear seepage.

- 4.3 Maintenance of Operating Facilities: It is not known how frequently the gate valve is operated and lubricated. Externally, the operating facilities appeared in good condition. The overflow weirs on the inlet tower were not blocked.

- 4.4 Warning System: At the present time, there is no warning system or evacuation plan in operation. It is recommended that a formal warning system be prepared and prominently displayed and furnished to all operating personnel. This should include:

- 1) How to operate the dam during an emergency.
- 2) Who to notify, including public officials, in case evacuation from the downstream area is necessary.
- 3) Procedures for evaluating inflow during the periods of emergency operation. Emergency periods would be based on a precipitation gauging station at Strasburg sewage treatment plant, which is located about two straight-line miles from the reservoir.

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4.5 Evaluation: Improved maintenance of the dam by controlling the clear seepage and tree growth is the most significant item in the operation of the dam. The gate valve should at least be opened annually, with care, in the absence of regular inspections. Improving the road to the dam is also recommended.

NAME OF DAM: STRASBURG

SECTION 5 - HYDRAULIC/HYDROLOGIC DESIGN

5.1 Design: The elevation of the crest (elevation 1404.0) of the principal spillway was established at an elevation which would provide the conservation storage required for the Town of Strasburg water supply. The principal spillway is of sufficient size to handle small discharges less than approximately five c.f.s. before flow passes from the emergency spillway. The crest (elevation 1404.5) of the emergency spillway was designed to pass all flows above normal pool elevation. According to design data received from Wiley and Wilson, the top of dam (elevation 1411.0) and the spillway were appropriately selected to pass approximately 2000 c.f.s. per square mile. The design plans show a trapezoidal shaped spillway 75 feet wide. However, field measurements indicate the width to be approximately 50 feet at the narrowest point. The spillway rating was therefore based upon 50 feet.

The limited hydrologic and hydraulic design data available necessitated the development of preliminary estimates of the spillway design flood as part of this report. The dam classification as a "significant" hazard- "small" size dam requires evaluation for a flood of a magnitude between a 100 year flood and one-half the Probable Maximum Flood (P.M.F.), according to the U.S. Army Corps of Engineers criteria as specified in Recommended Guidelines for Safety Inspection of Dams.

- 5.2 Hydrologic Records: None were available.
- 5.3 Flood Experience: No flood damage to the emergency spillway, the wooded area downstream of the spillway or the embankment were observed.
- 5.4 Flood Potential: Design features of the dam were established as noted in paragraph 5.1.
- 5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, paragraph 1.3.3.

Except for withdrawal for water supply, regulation of flow from the reservoir is automatic. Water rising above the crest of the principal spillway flows into this inlet and through the dam in a 48 inch corrugated metal pipe which makes a transition to a 36 inches square concrete conduit. Water also flows past the dam over the ungated emergency spillway, in the event, water in the reservoir rises over the crest of the spillway.

Outlet discharge capacity, reservoir area and storage capacity, and hydrograph and routing determinations were developed by Michael Baker, Jr., Inc. as preliminary estimates for this investigation.

The routing of the 100 year and one-half P.M.F. hydrographs began with the reservoir level at the crest of the principal spillway.

- 5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance in various hydrographs is shown in the following table:

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal	Hydrograph		
		100 yr(a)	1/2 P.M.F.(b)	P.M.F.(c)
Peak flow, c.f.s.				
Inflow	-	637	2675	-
Outflow	-	531	2553	-
Peak elev., ft. M.S.L.	1404.0	1407.7	1411.4	-
Emergency spillway				
Depth of flow, ft.	-	3.2	6.9	-
Avg. velocity, f.p.s.	-	4.6	11.0	-
Non-overflow section				
Depth of flow, ft.	-	-	0.4	-
Avg. veolocity, f.p.s.	-	-	2.4	-
Tailwater elev., ft. M.S.L.	-	-	-	-

(a) Based upon a 100 year, six hour rainfall.

(b) One-half P.M.F. by C.O.E. standards.

(c) The dam is classified as "significant" hazard. It does not have to pass the P.M.F. according to C.O.E. standards.

- 5.7 Reservoir Emptying Potential: The reservoir can be drained by opening a series of 12 inch gate valves to allow flow into the double chambered intake tower and eventually into the 36 inch square concrete conduit. The system will permit withdrawal of about 24 c.f.s. with the reservoir at the normal pool level and essentially dewater the reservoir in about 54 hours.

5.8 Evaluation: Hydrologic and hydraulic determinations for this project were not submitted by the owner or designer. It was therefore necessary to prepare estimates of these determinations. Based upon the hydrologic and hydraulic estimates, the dam will not pass one-half P.M.F. without overtopping. The dam will, however, pass the 100 year flood. The emergency spillway will pass approximately 40 percent of the P.M.F. without overtopping the dam embankment.

It should be indicated that conclusions pertain to present day conditions, and that the effect of future development on the hydrology has not been considered.

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SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: No geologic report or subsurface investigation was provided by the owner or designer. Observation of the water supply tunnel entrance on the right abutment indicated that the bedrock at this location is a red shaley sandstone.

6.2 Stability Analysis

6.2.1 Visual Observations: Structural inadequacies noted during the visual inspection of the dam are related to the clear seepage at the toe of the dam and at the right abutment.

6.2.2 Design Data: No stability analysis of the embankment was provided by the owner or designer and there is reason to believe none was made. However, it is sufficient to say that the clear seeps represent an undesirable condition. This condition may be assessed by determining the piezometric levels and the effect on the stability of the embankment and foundation before any type of remedial construction is proposed. Precautionary measures such as berms and filters can be constructed with the knowledge that these measures will reduce the risk of piping and slope failure.

6.2.3 Operating Records: Records of stability problems were not available.

6.2.4 Post-Construction Changes: Other than the excavation of the tunnel entrance, no post-construction changes were observed since the 1955 construction.

6.2.5 Seismic Stability: Strasburg Dam is in Seismic Zone 2 and represents no hazard from earthquakes according to the Recommended Guidelines for Safety Inspection of Dams.

6.3 Evaluation: Stability analyses of the downstream and upstream slopes are needed to evaluate the effect of the clear seepage and rapid drawdown on slope stability. Soil parameters and piezometer levels in the embankment and foundation should be obtained and used in the analyses.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: There are detrimental findings, concerning seepage as a result of this inspection. The spillway will pass the 100 year flood without overtopping the embankment. This is a minimum requirement consistent with the "significant" hazard classification of the dam. However, the one-half P.M.F. overtops the embankment by 0.4 feet.

Design plans were supplied by the Town of Strasburg. As-built drawings or construction specifications were not available.

Because of its "significant" hazard classification, measures to control the clear seepage need not be done immediately, but the clear seepage should be corrected following further investigation.

Further investigation is recommended to provide data to use in assessing embankment and foundation stability. Soil samples of the embankment should be obtained and tested for strength parameters. Piezometers should be installed to determine phreatic levels in the embankment and foundation.

7.2 Recommended Remedial Measures: The inspection revealed certain items of rehabilitation or other work which should be given high priority by the owners. These are:

- 1) The owners should control the clear seepage after definition by further investigation. This may be done with filters, berms and extension of surface and subsurface drains.
- 2) The owner should investigate the existence of the three inch cast-iron pipe that may be leaking at the toe of the dam.
- 3) The owner should remove all tree growth from the embankment.
- 4) The owner should repair clogged and damaged drains.
- 5) The owner should analyze the stability of the dam for various flood conditions.
- 6) The owner should perform downstream flood analyses to determine the effects of a potential failure.

- 7) The owner should develop and implement a precipitation-based warning system similar to the flash flood system developed by the U.S. Weather Bureau to protect the downstream residents and campers.

NAME OF DAM: STRASBURG

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APPENDIX I

PLATES

CONTENTS

Location Plan

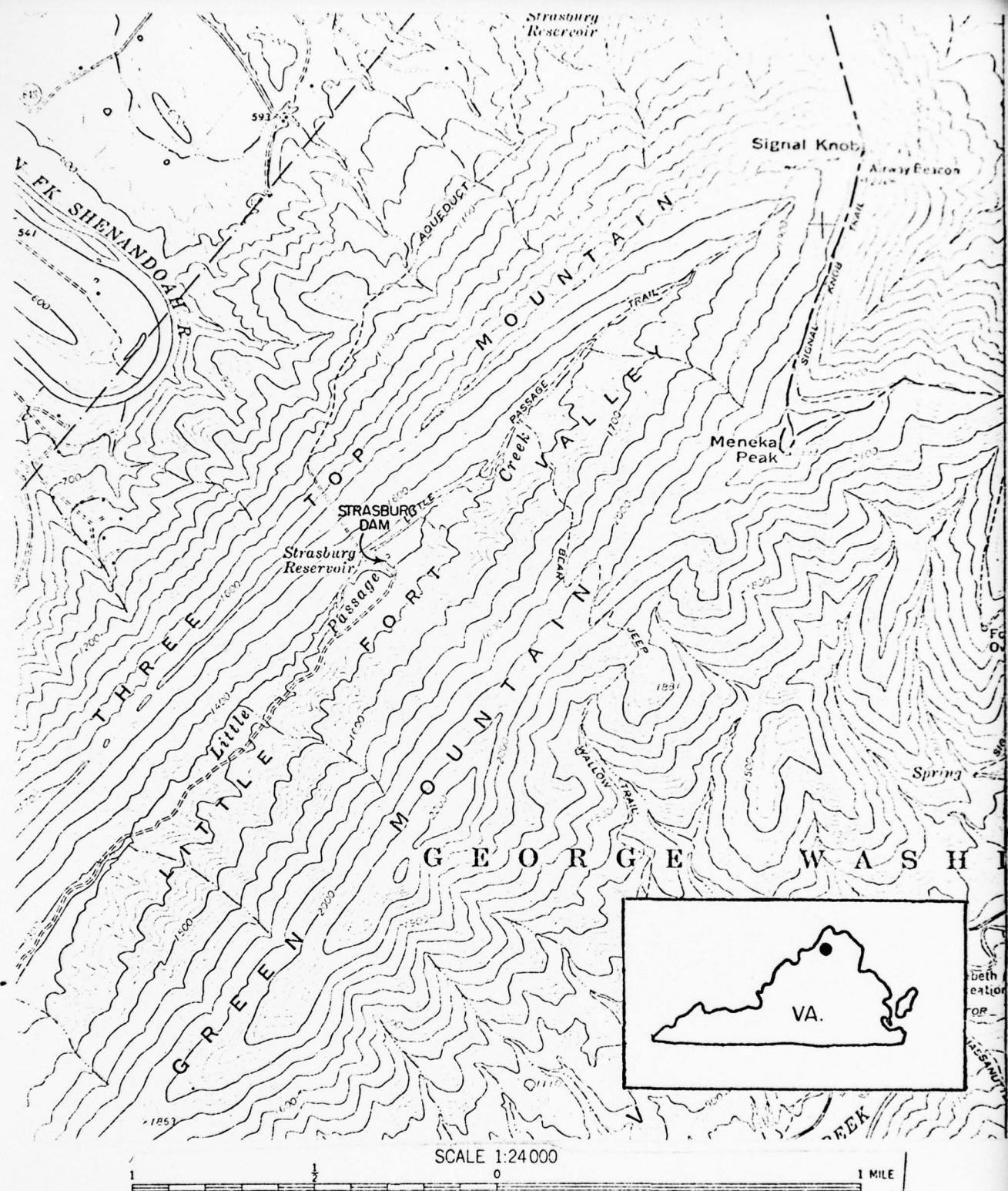
Plate 1: Plan of Dam and Spillway

Plate 2: Dam Cross Sections

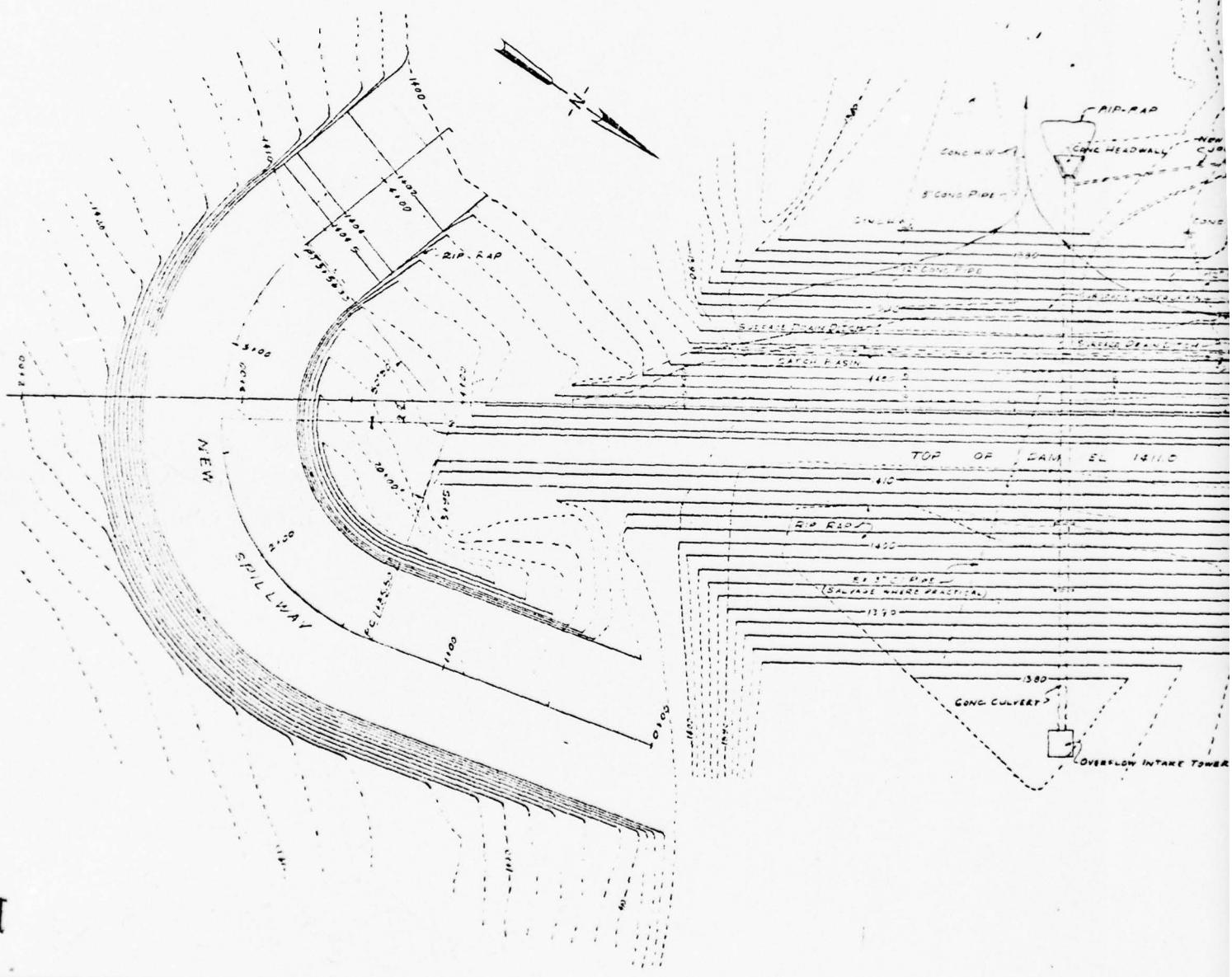
Plate 3: Overflow Intake Tower Details

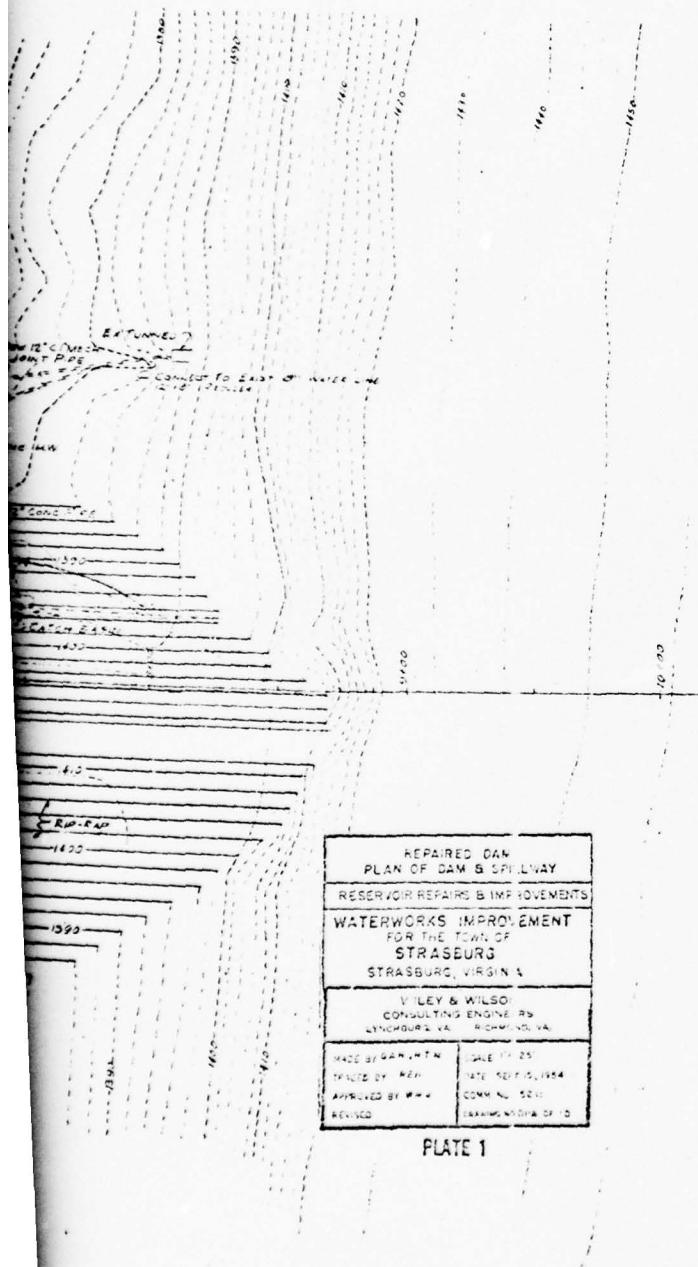
Plate 4: Plan of Clearing Area

Plate 5: Dam and Borrow Area Location



LOCATION PLAN
STRASBURG DAM





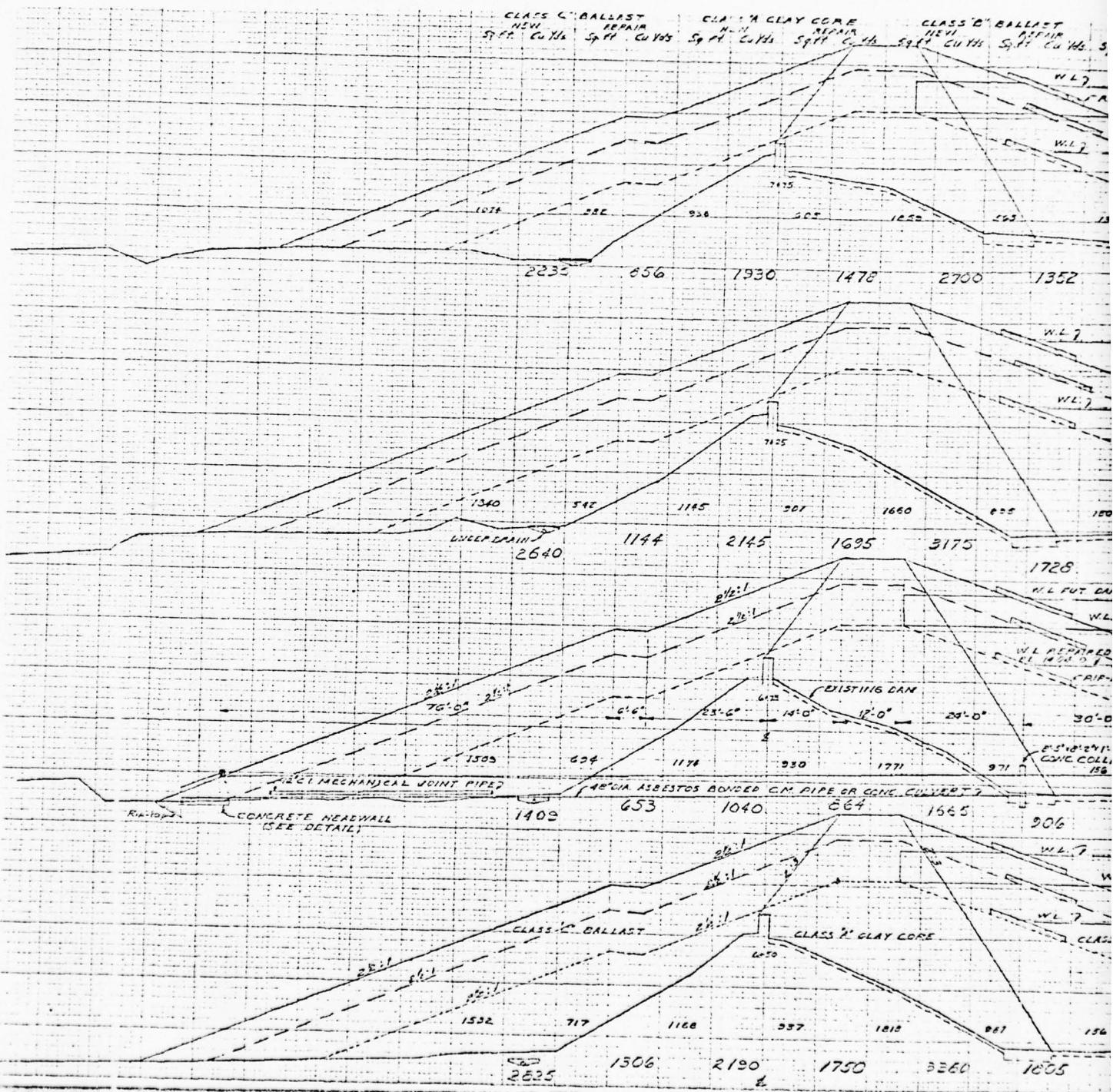
REPAIRED DAM
PLAN OF DAM & SPILLWAY
RESERVOIR REPAIRS & IMPROVEMENTS
WATERWORKS IMPROVEMENT
FOR THE TOWN OF
STRASBURG
STRASBURG, VIRGINIA

VILEY & WILSON
CONSULTING ENGINEERS
LYNCHBURG, VA - RICHMOND, VA

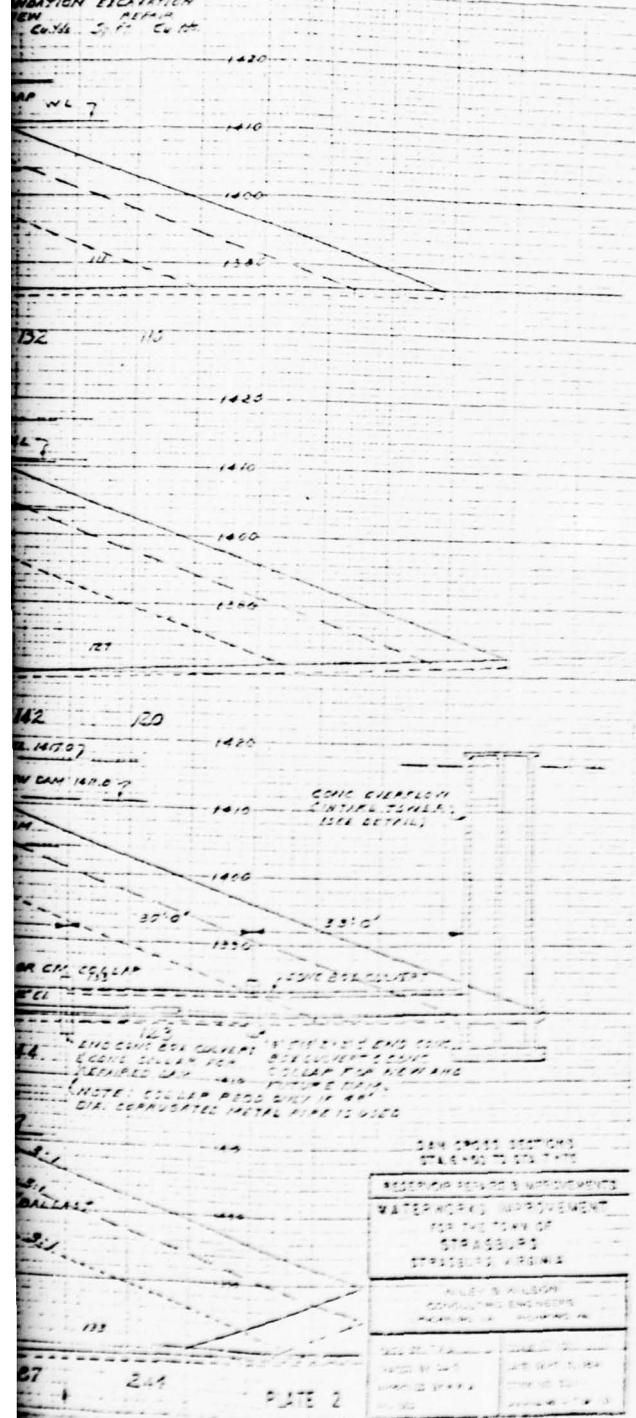
 MADE BY: REN. DATE: 11-25
 DRAWN BY: REN. DATE: SEPTEMBER 1954
 APPROVED BY: REN. COMM. NO. 524
 REVISED: EXAMINATIONS OF 10

PLATE 1

2

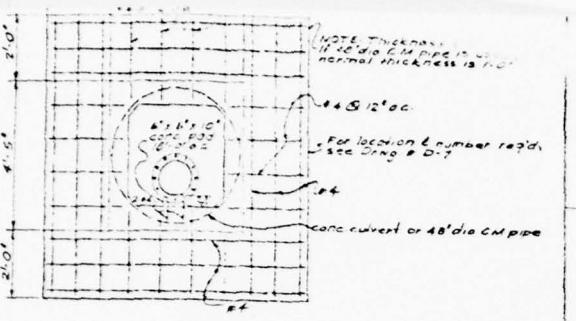


INJECTION EXCAVATION
TEN REPAIR
CUTS 5 FT. CUBIC



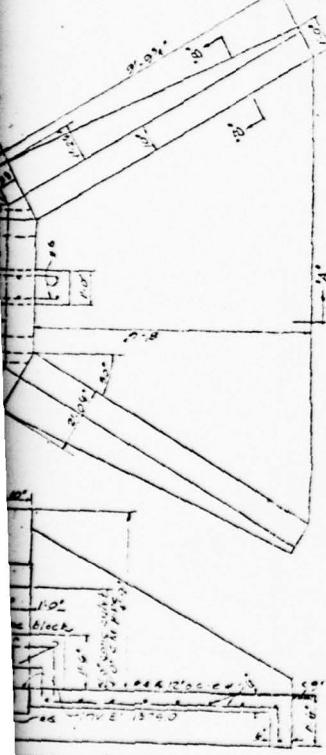
PAGE 2

SAN CAYO SECTIONS
STATE OF FLORIDA
WATERWORKS IMPROVEMENT
FOR THE TOWN OF
ST. GEORGE,
ST. GEORGE, VIRGINIA

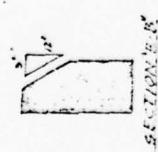


BOX CULVERT COLLAR DETAIL

$$= \text{cole} \mu^2 = 1.0$$



SECTION 'A-A'



PIPE COLLAR DETAIL
No Scale

OVERFLOW INTAKE TOWER DETAILS

RESERVOIR REPAIRS & IMPROVEMENTS

WATERWORKS IMPROVEMENT

FOR THE TOWN OF
STRASBURG
STRASBURG, MISSOURI

WILEY & WILSON
CONSULTING ENGINEERS
LYNCHBURG, VA. RICHMOND, VA.

BY E. S. SCALE AS SHOWN

JOHN C. BROWN DATE SEP 19, 1954

SEARCHED BY W.W.S. | CIRCLED NO. 5211

133246-81-3-58

PLATE 3

جیلیون

卷之三

55

PLAN OF CLEARING AREA NECESSARY FOR
CONSTRUCTION ON MCGAUGHEY MOUNTAIN
DAIRY AND WATER RESERVOIR FOR THE TOWN
OF STONEBURG, VIRGINIA.

WILLIAM J. WILSON - CONSULTING ENGINEER
RICHMOND, VA.
LUNCHBURG, VA.

DATE: Oct 10, 1954 SCALE: 1" = 200'

PLATE 4

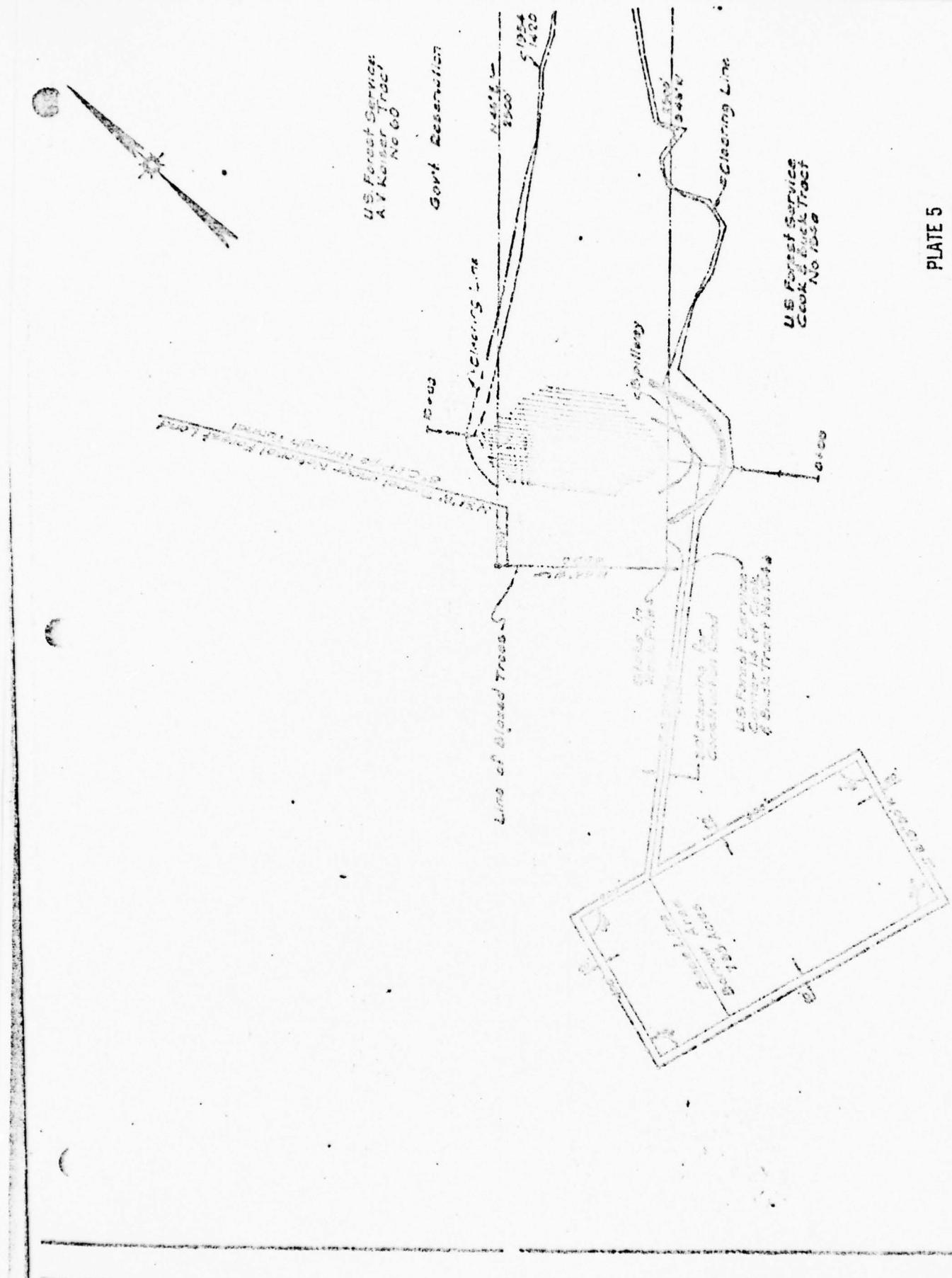


PLATE 5

APPENDIX II

PHOTOGRAPHS

CONTENTS

- Photo 1: Partially Clogged Left Subdrain Outlet
- Photo 2: Clear Seepage at Three Inch Pipe Location
- Photo 3: Partially Buried Right Surface Drain Outlet
- Photo 4: Upstream Slope of Embankment, Outlet Tower and Spillway Approach Channel
- Photo 5: Emergency Spillway Approach Channel

Note: Photographs were taken 1 June 1978.



PHOTO 1



PHOTO 2

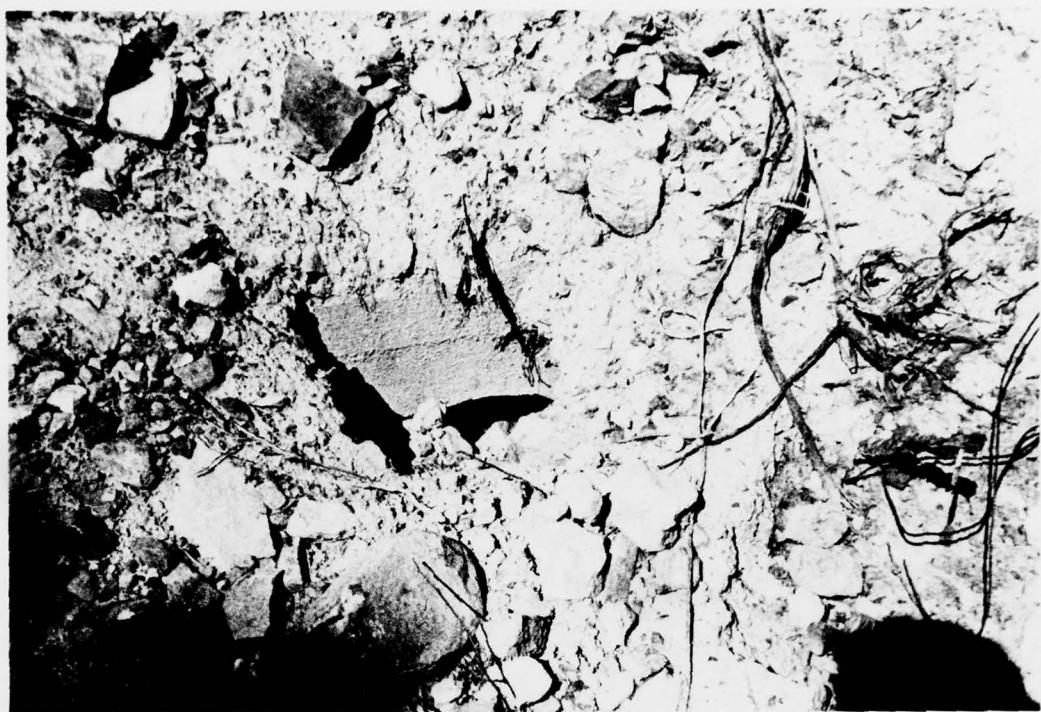


PHOTO 3

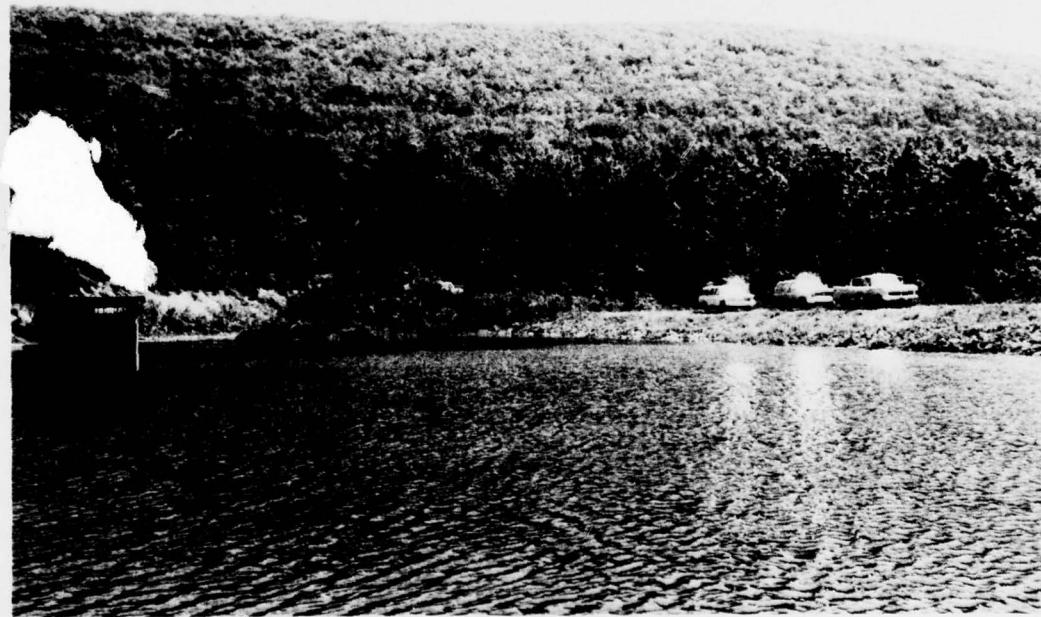


PHOTO 4



PHOTO 5

APPENDIX III

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name	Dam	County	Shenandoah	State	Virginia	Coordinates	Lat.	3856.7°
------	-----	--------	------------	-------	----------	-------------	------	---------

Date	Inspection	1 June 1978	Weather	Sunny	Temperature	65-85°F.
------	------------	-------------	---------	-------	-------------	----------

Pool Elevation at Time of Inspection 1406 M.S.L. Tailwater at Time of Inspection None M.S.L.

III-1

Inspection Personnel:

MICHAEL BAKER, JR., INC.:
J. Dziubek
D. Greenwood
J. Thompson

VIRGINIA WATER CONTROL BOARD:
T. Mizell

J. Dziubek
Recorder

Strasburg

EMBANKMENT

Sheet 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None were observed.	The downstream areas were heavily wooded.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None were observed.	
III-2 SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None were observed. There is no lining of earth gutters or downstream bench.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No horizontal displacement was observed. Right side of crest is 0.5 foot lower than left side. The crest elevation is eight feet less than shown on the plans.	
RIPRAP FAILURES	No evidence of displacement or stone movement was observed. Riprap is less than one foot above normal pool.	Because of the small amount of embankment freeboard, riprap should be extended to the crest elevation.

Strasburg

EMBANKMENT

Sheet 2

VISUAL EXAMINATION OF		OBSERVATIONS	REMARKS OR RECOMMENDATIONS
FOUNDATION		Rock exposed at the entrance to the tunnel on the downstream right abutment is red shaly sandstone. The material exposed at the emergency spillway excavation is weathered shale and sandstone. No foundation bedrock was exposed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM		The crest is approximately 1411 feet. No displacement was observed. No significant erosion was observed at these points.	Embankment length is 550 feet (Stations 3+25 to 8+75).
ANY NOTICEABLE SEEPAGE		There are four main locations of clear seepage: 1) Thirty feet downstream of toe; 50 feet left of subdrain outlet (one to two g.p.m.) 2) At position of three inch buried pipe (15 g.p.m.) 3) Embankment-Abutment contact--below downstream bench (one g.p.m.) 4) Embankment-Abutment contact--below downstream bench (one g.p.m.)	Piezometers should be installed to determine seepage pressure. Drain outlets should be cleared or repaired. Invert filter on berm may be needed.
STAFF GAGE AND RECORDER		None was observed.	A gate or recorder should be installed.
OUTLETS		Drainage trench is located at base of clay core according to the plans. Left outlet was flowing. Iron oxide slime and vegetation covered seven inches of the pipe diameter. Right surface drain outlet was buried by earth from nearby tunnel excavation. Water upwelling through soil at position of three inch cast-iron pipe.	Drain outlets should be cleaned and repaired.

III-3

Strasburg

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No weathering or cracking was observed. Bullet impact marks were present over most of the above water walls.	The impact marks should be repaired.
INTAKE STRUCTURE	Intake structure is a double chambered concrete riser. Foundation boxes are rock filled. Top elevation of riser is 1413 feet. The intake overflow levels are 1411 and 1406. The overflow intake tower is a 36 inch square box culvert with a 12 inch cast-iron pipe.	
OUTLET STRUCTURE	The water from the reservoir is carried in a 12 inch pipe which is enclosed in the 36 inch square concrete box structure. At the outlet end there are wing walls and a paved apron. After the paved apron, a rock fill protects the soil from erosion. All of these items were in very good condition.	
OUTLET CHANNEL	Outlet channel is grass covered and overgrown with little riprap. The channel is irregular and the flow generally appears to be limited.	
EMERGENCY GATE	Emergency gate is a 12 inch gate valve within the intake tower.	

Strasburg

UNGATED SPILLWAY

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE WEIR	None, the spillway channel is earthen.	
APPROACH CHANNEL	The approach channel is 50 feet wide. The crest elevation is 1404.5 feet. There is a great deal of spring fed water in the channel from the hillside cut.	
DISCHARGE CHANNEL	Discharge channel is 50 feet wide. The end of the channel is heavily wooded.	It may be necessary to clear the trees in order to prevent a reduction in spillway capacity.
BRIDGE AND PIERS	There are none.	

Strasburg

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None were observed.	
OBSERVATION WELLS	None were observed.	Wells or piezometers should be installed to measure seepage pressure.
WEIRS	None were observed.	
PIEZOMETERS	None were observed.	Wells or piezometers should be installed to measure seepage pressure.
OTHER		

Strasburg

RESERVOIR

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
SLOPES	The right abutment slope is 35 percent, and the left abutment slope is 15 percent. No erosion or slides were noted.	
SEDIMENTATION	No soundings were made; however, water in the reservoir was very clear.	

Strasburg

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Thick woods surround the channel. There are some fallen trees.	
SLOPES	Slopes were not measured.	Two farm dwellings are located approximately four miles downstream adjacent to Little Passage Creek. Campgrounds are located approximately eight miles downstream adjacent to Passage Creek.

APPENDIX IV

CHECK LIST - ENGINEERING DATA

Strasburg

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	A set of plans was furnished by the Town of Strasburg and has been submitted to the Norfolk District with this report.
REGIONAL VICINITY MAP	The Location Plan is attached.
CONSTRUCTION HISTORY	The dam was originally built in the 1920's with a concrete core wall. It was enlarged in the 1950's with a clay core. The design of the second stage was made by Wiley and Wilson, Inc.
TYPICAL SECTIONS OF DAM	Typical sections of the dam are enclosed in this Phase I Inspection Report.
IV-1 HYDROLOGIC/HYDRAULIC DATA	These data were taken from Wiley and Wilson design drawings. A summary of the data is attached.
OUTLETS - PLAN	This information is included in the plans furnished by the Town of Strasburg.
	<ul style="list-style-type: none">- DETAILS- CONSTRAINTS- DISCHARGE RATINGS
RAINFALL/RESERVOIR RECORDS	No known rainfall and water level records are available. Regional rainfall data are available from the Virginia Climatological records.

Strasburg

<u>ITEM</u>	<u>REMARKS</u>
DESIGN REPORTS	No design reports were available.
GEOLOGY REPORTS	No geology reports were available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	These data were furnished by Wiley and Wilson, Inc.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None of these data were available.
POST-CONSTRUCTION SURVEYS OF DAM	No construction information or inspection reports are available.
BORROW SOURCES	No borrow area locations were shown on the plans. There are indications that the borrow area was located 1000 feet downstream on the left hillside.

Strasburg

<u>ITEM</u>	<u>REMARKS</u>
MONITORING SYSTEMS	No monitoring system for ground water was designed or installed. No flow measuring devices were included in the plans except for the overflow sections of the intake tower.
MODIFICATIONS	The dam was enlarged to its present size in the 1950's. Although it does not appear to be a modification, the present crest elevation is eight feet lower than the crest elevation shown in the plans.
HIGH POOL RECORDS	No reservoir levels records were available.
IV-3 POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	No post-construction reports were available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None were reported by the owner.
MAINTENANCE OPERATION RECORDS	No such records were available.

Strasburg

<u>ITEM</u>	<u>REMARKS</u>
SPILLWAY PLAN	This information is shown on the plans.
SECTIONS	
DETAILS	

OPERATING EQUIPMENT
PLANS & DETAILS Drawings of the operating equipment are included in the plans.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.89 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1404.0 (54.6 Acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1404.5 (58.0 Acre-feet)

ELEVATION MAXIMUM DESIGN POOL: 1411

ELEVATION TOP DAM: 1411

CREST: Emergency Spillway

- a. Elevation 1404.5
- b. Type Side channel earth and rock cut
- c. Width 50 feet
- d. Length 435 feet
- e. Location Spillover Over left abutment downstream of dam
- f. Number and Type of Gates None

OUTLET WORKS:

- a. Type Concrete tower
- b. Location Approximate center of upstream toe
- c. Entrance inverts Overflow weirs
- d. Exit inverts 36 inches square box conduit
- e. Emergency draindown facilities 12 inch gate valve

HYDROMETEOROLOGICAL GAGES: None

- a. Type
- b. Location
- c. Records

MAXIMUM NON-DAMAGING DISCHARGE Not known

Name of Dam: Strasburg

APPENDIX V

INFORMATION FROM THE DESIGN ENGINEER

WILEY & WILSON, INC.

A PROFESSIONAL CORPORATION

ENGINEERS • ARCHITECTS • PLANNERS

FOUNDERS

E. C. WILEY, PE 1870-1945
E. J. P. WILSON, PE 1884-1961

OFFICERS

B. G. WATKINS, JR., PE
KENT EVANS, JR., PE

DIRECTORS

W. M. JOHNSON, PE, CP	L. P. WADE, PE
T. R. LEACHMAN, AIA	W. M. GREENWOOD, PE
J. R. BOOTON, PE	

CONSULTANT

E. B. BOYNTON, PE

RETIRED

W. E. ROYALL, PE

2310 LANGHORNE ROAD

P. O. BOX 877

LYNCHBURG, VA. 24505

804-847-0102

ASSOCIATES

C. J. SIEGRIST, JR., PE	R. L. NICHOLS, JR., PE
M. K. SHELTON, AIA	W. B. MCLEN, PE
T. J. ETHERTON, JR., AIA	W. H. CLINGENPEEL, PE
H. L. LYTTON, AIA	M. K. JONES, JR., PE
C. H. MITCHELL, JR., PE	G. H. BARNES, JR., AP
W. A. STUART, II, PE	D. P. MANNING, PE
W. D. WRIGHT, PE	G. W. BURTON, PE
R. F. JEFFRIES, PE	F. R. MAYS, PE
I. D. AUSTIN, PE	R. G. ROBISON, PE
D. H. JONES, JR., PE	J. K. SPENCER, III, PE
O. E. CRAFT, JR., PE	W. R. STABEND, PE
W. F. CLINE, PE	J. B. STEADMAN, PE
S. T. THOMPSON, JR., PE	J. C. PAGE, RA
J. L. THOMPSON, PE	R. A. LEMON, PE

June 14, 1978

1978-77
6/10/78
PLIB-A-11-16
EJG-201a

DIG

Mr. David J. Greenwood, P.E.
Michael Baker, Jr., Inc.
Box 280
Beaver, Pennsylvania 15009

Re: Town of Strasburg, Virginia
Inspection of Dam

Dear Mr. Greenwood:

In response to our conversation by telephone and your letter of June 8, 1978 we have reviewed our files for the above project in an effort to locate the information requested.

We have found considerable information regarding the preliminary design of the spillway for this dam but have not found the final design calculations. The design was based on a drainage area of 0.973 square miles and a maximum runoff of 2,000 cfs per square mile; therefore, the maximum design flood flow was 1,928 cfs. The spillway design was based on the broad crested weir formula $Q = 3.087 L (H+Hy)^{3/2}$. We have not found any evidence that spillway rating curves or storage vs elevation curves were developed.

In regard to the question concerning the height of the dam, it appears that bids were received on two different heights and the lower height was selected because of a lack of funds for the higher dam.

We are enclosing copies of the calculations for the drainage area, correspondence regarding approval of the dam by the U. S. Forest Service and the State Department of Health, excerpts from the specifications regarding bids on different heights of dam, a copy of the form of proposal submitted by the low bidder, a copy of a letter regarding the award of the contract and a copy of the contract.

Mr. David J. Greenwood, P.E.

-2-

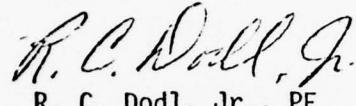
June 14, 1978

Although a full-time project representative was present throughout the construction, we have not been able to locate the daily inspection reports. It is possible that the Town has these reports in their file.

Our invoice for researching the files and providing copies of the enclosed data is being submitted with a copy of this letter to the Town of Strasburg.

Very truly yours,

WILEY & WILSON, INC.



R. C. Dodl, Jr., PE

RCD:vs

Enclosures

cc: Mr. Wesley Welch

Strasburg Dam

CJS Jan 17, 55

(Drainage Area.

1. By U.S.G.S - Luray Sheet Scale 1:125,500
 $1 \text{ in} = 3.892 \text{ Sq Miles}$
Area by Planimeter = .29 in²

$$\text{Area Watershed} = .29 \times 3.892 = \underline{\underline{1.125}} \text{ Sq Miles}$$

2. By U.S.G.S - Strasburg Sheet - Scale 1: 62,500
 $1 \text{ in} = .373 \text{ Sq Miles}$

$$\text{Area by Planimeter} = .99 \text{ in}^2$$

$$\text{Area Watershed} = .99 \times .373 = \underline{\underline{.964}} \text{ Sq Miles}$$

3. Strasburg Sheet Area more accurate!

U
USGS
Strasburg, Town of
Reservoir
7/1/22 - #365

WILEY & WILSON

JAN 6 1955

WILEY & WILSON

January 6, 1955

Mr. J. Ray Miller
Mayor, Town of Strasburg
Strasburg, Virginia

Dear Mr. Miller:

Reference is made to your application for the use of National Forest land in connection with the improvement of the Town of Strasburg's reservoir dam.

Ranger Eger has supplied this office with one set of design drawings and specifications covering the proposed work.

Since a part of the structure will be located on National Forest land its design must be approved by the Chief, Forest Service. Three additional sets of drawings and specifications and a report of the hydrology study made by the consulting engineers will be required to submit the case to the Chief.

In order to expedite the matter we called Mr. McNutt of Wiley and Wilson and requested him to furnish the additional plans, etc. We also requested a statement regarding the foundation condition.

We regret the delay in the issuance of your permit, but hope these final details may be cleared within a short time.

A copy of this letter is being forwarded to Wiley and Wilson.

Very sincerely yours,

A. H. ANDERSON

A. H. ANDERSON
Forest Supervisor

cc-Joe R. D.
✓ Mr. McNutt, Wiley
and Wilson

Note - Map filed in Map Book
Strasburg U.S.G.S.
Edition of 1950.

George Washington National Forest.

Permission is hereby granted to Town of Strasburg, Virginia, hereinafter called the permittee, to use, subject to the conditions set out below, the following-described lands or improvements:

A portion of U. S. Tracts No. 154a (Cook and Buck) and No. 60 (A. V. Kaiser) to be occupied by portions of the Town of Strasburg's enlarged dam and facilities, and a right of way for existing 8" pipe line through tunnel extending across U. S. Tracts No. 60 (A. V. Kaiser) and No. 68 (Rickett and Graham) for a distance of 1,760 feet. All of the above lies in Shenandoah County, Virginia, as shown on the attached drawings which are made a part of this permit.

This permit covers approximately 10 acres for the purpose of:

Repairing and enlarging present dam to extend on Government land as shown as "Repaired Dam" on the attached drawings. Construction shall be in accordance with approved specifications prepared by Wiley and Wilson, Consulting Engineers, and shall also comply with the following:

1. The spillway shall be made adequate to discharge a maximum runoff of 2,000 c.f.s. per square mile with a freeboard of not less than 2 feet and shall be constructed so as to prevent possible erosion.
2. If deemed necessary by Forest Service engineers, erosion control devices shall be promptly installed to protect the slope between the spillway outlet and the existing stream channel.

The exercise of any of the privileges granted in this permit constitutes acceptance of all the conditions of this permit. This permit is issued free under Regulation U-11.

1. Construction or occupancy and use under this permit shall begin within one month, and construction, if any, shall be completed within 12 months, from the date of the permit. This use shall be actually exercised at least 365 days each year, unless otherwise authorized in writing.

2. Development plans; lay-out plans; construction, reconstruction, or alteration of lay-out or construction plans for this area must be approved in advance and in writing by the forest supervisor. Trees or shrubbery on the permitted area may be removed or destroyed only after the forest officer in charge has approved, and has marked or otherwise designated that which may be removed or destroyed. Merchantable timber cut must be paid for by the permittee. Trees, shrubs, and other plants may be planted in such manner and in such places about the premises as may be approved by the forest officer in charge.

3. The permittee shall maintain the improvements and premises to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the forest officer in charge.

4. This permit is subject to all valid claims.

5. The permittee, in exercising the privileges granted by this permit, shall comply with the regulations of the Department of Agriculture and all Federal, State, county, and municipal laws, ordinances, or regulations which are applicable to the area or operations covered by this permit.

... the permittee shall take all reasonable precautions to prevent and suppress forest fires. No material shall be disposed of by burning in open fires during the closed season established by law or regulation without a written permit from the forest officer in charge or his authorized agent.

7. The permittee shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this permit, and shall pay the United States for any damage resulting from negligence or from the violation of the terms of this permit or of any law or regulation applicable to the national forests by the permittee, or by any agents or employees of the permittee acting within the scope of their agency or employment.

8. The permittee shall fully repair all damage, other than ordinary wear and tear, to national forest roads and trails caused by the permittee in the exercise of the privilege granted by this permit.

9. No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this agreement or to any benefit that may arise herefrom unless it is made with a corporation for its general benefit.

10. Upon abandonment, termination, revocation, or cancellation of this permit, the permittee shall remove within a reasonable time all structures and improvements except those owned by the United States, and shall restore the site, unless otherwise agreed upon in writing or in this permit. If the permittee fails to remove all such structures or improvements within a reasonable period, they shall become the property of the United States, but that will not relieve the permittee of liability for the cost of their removal and restoration of the site.

11. This permit is not transferable. If the permittee through voluntary sale or transfer, or through enforcement of contract, foreclosure, tax sale, or other valid legal proceeding shall cease to be the owner of the physical improvements situated on the land described in this permit and is unable to furnish adequate proof of ability to redeem or otherwise reestablish title to said improvements, this permit shall be subject to cancellation. But if the person to whom title to said improvements shall have been transferred in either manner above provided is qualified as a permittee, and is willing that his future occupancy of the premises shall be subject to such new conditions and stipulations as existing or prospective circumstances may warrant, his continued occupancy of the premises may be authorized by permit to him if, in the opinion of the forest supervisor, issuance of a permit is desirable and in the public interest.

12. In case of change of address, the permittee shall immediately notify the forest supervisor.

13. The temporary use and occupancy of the premises and improvements herein described may not be sublet by the permittee to third parties without the prior written approval of the forest supervisor and the permittee shall continue to be responsible for compliance with all conditions of this permit by persons to whom such premises may be sublet.

14. This permit may be terminated upon breach of any of the conditions herein or at the discretion of the regional forester or the Chief, Forest Service.

15. In the event of any conflict between any of the preceding printed clauses or any provision thereof and any of the following clauses or any revision thereof, the preceding printed clauses will control.

16. This permit is subject to the conditions set forth above and to conditions #18 to #28 attached hereto and made a part of this permit.

/s/ J. N. Jefferson

Date January 10, 1966

V-6

17. The permittee shall be responsible for the acts of the construction and maintenance organization or contractors.
18. All temporary structures used in connection with construction shall be moved when construction has been completed. All temporary roads shall be obliterated and treated to the satisfaction of the Forest Officer in charge.
19. This permit is confined to the purposes specified and the Forest Service retains the right to use the land for any other purpose not inconsistent therewith.
20. In the control of water covered by this permit, the riparian rights of others must be duly protected by the permittee.
21. Any damage caused by the permittee or his agents to Forest Service maintained roads or to woods roads shall be repaired at the expense of the permittee.
22. The area and improvements shall at all reasonable times be open to inspection and examination by Forest Officers and inspectors and officers of the United States.
23. All borrow pits or scars shall be graded to slopes that permit revegetation, treated and maintained in a manner such that the area will be permanently vegetated.
24. The permittee shall be responsible for the continuous maintenance of all improvements and structures on National Forest land. Such maintenance shall include the assurance of (1) a water tight dam; (2) vegetative cover on all exposed dam slopes, borrow pits, and scars; (3) removal of tree or brush growth on the dam slopes and spillway opening; (4) removal of obstructions to the spillways.
25. Facilities necessary for public safety are the responsibility of the permittee.
26. The permittee, in the performance of this permit, shall not discriminate against any employee or applicant for employment because of race, creed, color, or national origin and shall include in all sub-contracts a provision imposing a like obligation on sub-contractors.
27. This permit shall have no force and effect until the permittee has signified acceptance of its provisions and conditions by signing below and returning the duplicate copy to the Forest Supervisor.

This permit is accepted subject to the conditions set out above.

THE TOWN OF STRASBURG, VIRGINIA

By /s/ J. Ray Miller

Feb. 1, 1955. _____ Title Mayor _____

COMMONWEALTH OF VIRGINIA



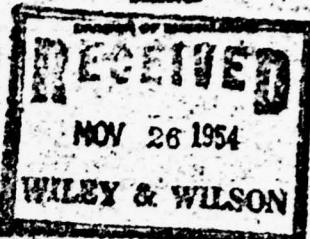
L. A. ROBERTS, M.D.
COMMISSIONER

DEPARTMENT OF HEALTH
RICHMOND, VA

RICHARD HENRICKSON
DIRECTOR

PLANS HEREBY REPLIED TO
BUREAU OF ENGINEERS,
ENGINEERING DEPARTMENT

PERMIT NO. 735, STRASBURG, VA.



To Construct and Operate Additions to the Existing
Water Filtration Plant and Improve and Enlarge the
Existing Pumping Station and Reservoirs.

In accordance with the provisions of Title 42, Chapter 3, Section 62-50,
Code of Virginia (1950).

The Town of Strasburg, Virginia, proposes to construct and operate a 300,000 gallon
per day water filtration plant and improve and enlarge the existing plant
so as will be sufficient to supply the needs of the town and surrounding areas.
The plant will be located on the site of the existing plant, and will consist of the
plant area bounded by the following lines: From the corner of Main Street and
High Street, running due west to the corner of High Street and Court Street, and thence
due north along Court Street to the corner of Court Street and Main Street, and
due east along Main Street to the corner of Main Street and High Street, and
due south along High Street to the corner of High Street and Main Street, and
all dated November 22, 1954.

Division of Health

Frank D. Shadoff
State Health Commissioner

November 22, 1954

1200/MS

DIVISIONS OF WORK

Division No. I - Filter Plant Improvement. The work under this division consists of the enlargement and improvement of the existing filter plant by the construction of a 370,000 gallon per day addition to the present plant, including new mixing basin, new coagulating or settling basin, new filter and filter gallery, new clear well, new addition to filter coal house, new blower, new dry chemical feeder, new high head clear water pump and all new plant piping, fittings, and accessories necessary for the complete installation of a 370,000 gallons per day addition to the existing filter plant.

Division No. II - Massanutten Mountain Reservoir Repair and Enlargements. The work under this division consists of the repair of the existing Massanutten Mountain Raw Water Reservoir Dam, including the removal of all weathered material, organic matter, unstable substances and spillway concrete from the existing dam structure; replacing, reshaping, and extending the dam slopes with selective material to the new cross-sections shown on the plans; the construction of an intake and overflow tower, connecting piping, spillway, and all other incidentals thereto, as described in the specifications, detailed on the drawings, or as may be required for the complete repair of the Massanutten Mountain Raw Water Reservoir Dam.

Alternate No. 3 to Division No. II - Repair and Enlargement to the Massanutten Mountain Reservoir and Dam. The work covered by this alternate plan for repair and enlargement of the reservoir and dam includes the work described under Division No. II for Massanutten Mountain Reservoir Dam Repair, and in addition thereto, includes raising of the dam and enlargement of the reservoir as shown by the New Dam sections on the plans as described herein, and as may be required for the complete repair and enlargement of the Massanutten Mountain Reservoir.

Bidders may submit individual proposals for the various divisions of the work or a combination proposal for all divisions and alternatives for the entire project.

Proposal No. 1 - Division No. I - for Filter Plant Improvements, shall be an all-inclusive, firm, lump sum bid, based on the bidder's own quantity estimate and pricing of the work to be done under this Division.

Proposal No. 2 - Division No. II - Massanutten Mountain Reservoir for Repair, shall be based on the quantities given in the Form of Proposal for each item of material or construction work, multiplied by the bidder's unit price for the respective item, and the total extended for the item. The grand total of all item totals will be considered as the lump sum bid in awarding the contract.

Alternate Proposal No. 3 - Division No. II for Repair and Enlargement to the Massanutten Mountain Reservoir and Dam shall be prepared in the same manner as Proposal No. 2, and includes only the additional quantities required to raise the dam and enlarge the reservoir. Proposal No. 2, Division No. II, combined with Alternate Proposal No. 3, Division No. II, will be for construction of the Dam and Reservoir as shown by the New Dam Sections on the plans and described herein.

Combination Proposal No. 4 - shall be a lump sum bid for all work to be performed under Proposal No. 1 for Division No. I for Filter Plant Improvements, and Proposal No. 2 for Division No. II - Massanutten Mountain Reservoir Dam Repairs.

Combination Proposal No. 5 - shall be a lump sum bid including the work to be performed under Proposal No. 1 for Division No. I - Filter Plant Improvements, and Proposal No. 2, Division No. II combined with Alternate Proposal No. 3 for Massamutten Mountain Reservoir Dam Repairs and Enlargement.

Alternate Proposal No. 6 is a deduction or omission for substituting 186' of 48" dia. corrugated metal pipe, and 63' of 3' x 3' reinforced concrete culvert for the 249' of 3' x 3' reinforced concrete culvert through the Dam to Proposal No. 2, Division No. II, or to Combination Proposal No. 4.

Alternate Proposal No. 7 is a deduction or omission for substituting 216' of 48" dia. corrugated metal pipe, and 33' of 3' x 3' reinforced concrete culvert for the 249' of 3' x 3' reinforced concrete culvert through the Dam to Proposal No. 2, Division No. II, combined with Alternate Proposal No. 3, Division No. II, or Combination Proposal No. 5.

FORM OF PROPOSAL

John W. May Miller, Mayor
Town of Strasburg
Strasburg, Virginia

Dear Sir:

We hereby propose to furnish all labor, tools, construction plant, materials and appliances necessary for the construction of the Addition to the existing Filter Plant and the Repairs and Improvements to the existing Massanutten Mountain Reservoir and Dam, all as indicated on the Plans and Specifications for Water Works Improvements for the Town of Strasburg, Virginia, prepared by Wiley & Wilson, Consulting Engineers and dated September 15, 1954, for the following divisions of work:

Proposal No. 1 - Division No. I -- For Filter Plant Improvements including the construction of a 320,000 Gallon Per Day addition to the present plant, including new mixing basin, new coagulating or settling basin, new filter and filter gallery, new clear well, new addition to filter head house, new chlorinator, new dry chemical feeder, new high head clear water pump and all new plant piping, fittings, and accessories necessary for the complete installation for the sum of Fifty Four Thousand

Four Hundred and No/100 DOLLARS (354,400⁰⁰).

Proposal No. 2 - Division No. II -- For the Massanutten Mountain Reservoir Repairs and Enlargements (Top Dam Elevation 1411.0) including the removal of all weathered material, organic matter, unstable substances and spillway concrete from the existing dam structure; replacing, reshaping, and extending the dam slopes with selective material to the new cross-sections shown on the plans; the construction of an intake and overflow tower, connecting piping, spillway, and all other incidentals thereto, for the unit prices and total sum based upon the itemized quantities as follows:

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>No. Units</u>	<u>Unit Price</u>	<u>Total</u>
1	Clearing and Grubbing;	Acrea	4.55	\$ 40 ⁰⁰ /"	\$ 182.00
2	Clearing	Acrea	3.45	\$ 30 ⁰⁰ /"	\$ 103.50
3	Foundation Excavation	Cu. Yds.	2,369	\$ 1.50/	\$ 3,553.50
4	Regular Excavation and Borrow	Cu. Yds.	31,097	.60	20,458.20
					\$ 18,775.70

		No.	Unit	Item	Total
22	Excavation	122	Yds.		
	Excavation to or below M.L. including complete inclining and concrete reinforcement at 6' and 12' elevations, including excavation, stone and gravel, soil, concrete steps, and C.I. embank- ment and covers		Lsp.	1	<u>9500⁰⁰</u> <u>9500⁰⁰</u>
3	Concrete Culvert 3'x5' complete including concrete and reinforcing steel, 12" Mech. Joint C.I. pipe, ittings, and supports, 1 con- crete collar and 1 concrete head- wall		Lin. Ft. 219		<u>46⁰⁰</u> <u>11,454⁰⁰</u>
7	12" C.I. Mech. Joint Pipe, com- plete including excavation and backfill		Lin. Ft. 126		<u>8⁰⁰</u> <u>1015⁰⁰</u>
8	12" x 8" C.I. Mech. Joint Reducer and connection to existing 8" water line	1	Lin.		<u>100⁰⁰</u> <u>100⁰⁰</u>
9	Rip Rap - Dry		Sq. Yds. 682		<u>3⁰⁰</u> <u>2046⁰⁰</u>
10	Rip Rap - Grouted in Place		Sq. Yds. 33		<u>41⁰⁰</u> <u>132⁰⁰</u>
11	Catch Pasing Complete	2	Eq.		<u>150⁰⁰</u> <u>300⁰⁰</u>
12	Concrete Headwalls for 8" and 12" Pipe	3	Pa.		<u>100⁰⁰</u> <u>300⁰⁰</u>
13	Underdrain Complete Including Pipe	Lin. Ft. 452			<u>3⁰⁰</u> <u>1617⁰⁰</u>
14	12" Concrete Pipe Complete In- cluding Excavation & Backfill	Lin. Ft. 164			<u>3⁰⁰</u> <u>492⁰⁰</u>
15	8" Concrete Pipe Complete Including Excavation and Backfill	Lin. Ft. 70			<u>2⁰⁰</u> <u>125⁰⁰</u>
16	Gr. Scrim:	3.25	Aero		<u>300⁰⁰</u> <u>900⁰⁰</u>
17	Gr. Joint:	7.25	Aero		<u>100⁰⁰</u> <u>900⁰⁰</u>
	Total Material for a - Division No. II (Excav. & C.I. Inclusive)				<u>55,550⁷⁹</u>

McGraw's Proposal No. 1 - Division No. II - Job #1 and only segment
of the Mountain Reservoir and Dam (Additional quantities required to
be furnished from the New Sea elevation of 1410.0) per the unit prices and total
amounts over the itemized quantities as follows:

<u>Item</u>	<u>Description</u>	<u>Unit</u>	<u>No Units</u>	<u>Unit Price</u>	<u>Total</u>
18	Soiling; and Grubbing	Acre	1.71	\$.40 ⁰⁰	\$ 684.00
19	Soiling	Acre	1.71	\$.40 ⁰⁰	\$ 684.00
20	Excavation Excavation	Cu. Yds.	502	\$ 1.72	\$ 861.60
21	Excavation and Borrow	Cu. Yds. 10,776		\$.50	\$ 5,388.00
22	Adding 6'-0" to Overflow Intake Tower Height (Top Bl. 1419.0)	Linear	1	\$ 1,300.00	\$ 1,300.00
23	Concrete Culvert 3'x3'; complete Including concrete and rein- forcing steel, 12" Mech. Joint C.I. pipe and fittings and supports 1 concrete collar and 1 concrete headwall		None		
24	12" C.I. Mech. Joint Pipe, complete including excavation and backfill		None		
25	12" x 8" C.I. Mech. Joint Reducer and connection to existing 8" water line		None		
26	Rip Rap - Dry	Sq. Yds.	150	\$.50 ⁰⁰	\$ 450.00
27	Rip Rap ~ Grouted in Place	Sq. Yds.	85	\$.11 ⁰⁰	\$ 93.50
28	Catch Basins Complete		None		
29	Concrete Headwalls for 8" and 12" Pipe		None		
30	Underdrain Complete Including Pipe	Lin. Ft.	58	\$.35 ⁰⁰	\$ 20.30
31	.12" Concrete Pipe Complete In- cluding Excavation & Backfill	Lin. Ft.	36	\$.30 ⁰⁰	\$ 10.80
32	.8" Concrete Pipe Complete In- cluding Excavation and Backfill		None		
33	Top Soiling	Acres	1.34	\$.30 ⁰⁰	\$ 40.20
34	Seeding	Acres	1.34	\$.30 ⁰⁰	\$ 40.20
Total Alternate Proposal No.3 -Division No. II (Items 18 - 34 Inclusive)					<u>\$ 20,538.00</u>
Grand Total Proposal No. 2 - Division No. II and Alternate Proposal No. 3 - Division No. II (Items 1 - 34 Inclusive)					<u>\$ 76,088.00</u>

One Hundred Six Thousand and 20
DOLLARS (\$106,000⁰⁰).

Alternate Proposal No. 6 - If the 249 Lin. Ft. of 3' x 3' reinforced concrete box culvert through the dam is changed to 43 Lin. Ft. of 3' x 3' reinforced concrete box culvert and 186 Ft. of 18" diameter, 8 gauge, shop strutted, asbestos bonded, corrugated metal culvert pipe with 1 concrete and 1 corrugated metal collar, you may add or deduct from (cross out one) Proposal No. 2 and Combination Proposal No. 4 the sum of Two Thousand Six Hundred Twenty-Eight Thousand and 100 DOLLARS (\$126,000⁰⁰).

Alternate Proposal No. 6 - If the 249 Lin. Ft. of 3' x 3' reinforced concrete box culvert through the dam is changed to 43 Lin. Ft. of 3' x 3' reinforced concrete box culvert and 186 Ft. of 18" diameter, 8 gauge, shop strutted, asbestos bonded, corrugated metal culvert pipe with 1 concrete and 1 corrugated metal collar, you may add or deduct from (cross out one) Proposal No. 2 and Combination Proposal No. 4 the sum of Two Thousand Six Hundred
and 100 DOLLARS (\$2,600⁰⁰).

Alternate Proposal No. 7 - If the 249 Lin. Ft. of 3' x 3' reinforced concrete box culvert through the dam is changed to 33 Lin. Ft. of 3' x 3' box culvert and 216' of 18" diameter, 8 gauge, shop strutted, asbestos bonded, corrugated metal culvert pipe with 1 concrete and 1 corrugated metal collar, you may add or deduct from (cross out one) Proposal No. 2 - Division II and Alternate Proposal No. 3 - Division No. II (Items 1 - 34 Inclusive) or Combination Proposal No. 5 the sum of Three Thousand
and 100 DOLLARS (\$3,000⁰⁰).

The following unit prices shall be used to cover changes from the plans and specifications either as additions or deductions or to take care of any extra work or changes desired or required in connection with the awarding of contracts and/or completion of the project.

Class "A" Concrete in place	<u>35⁰⁰</u>	per Cu. Yd.
Reinforcing Steel in place	<u>14</u>	per Lb.
Brick Masonry in place	<u>15.75</u>	per Thous.
Concrete Forms in place	<u>60</u>	per Sq. Ft.
5" Cast Iron Pipe in place	<u>3.50</u>	per Lin. Ft.
8" Cast Iron Pipe in place	<u>7.00</u>	per Lin. Ft.
10" Cast Iron Pipe in place	<u>9.25</u>	per Lin. Ft.
12" Cast Iron Pipe in place	<u>11.50</u>	per Lin. Ft.
6" Gate Valves in place	<u>56.00</u>	ea.
8" Gate Valves in place	<u>110.00</u>	ea.
10" Gate Valves in place	<u>157.50</u>	ea.
12" Gate Valves in place	<u>200.00</u>	ea.

200
100
50
25
12.5

I, the undersigned, do hereby agree to do all parts of this contract and give bond in the sum of \$10,000 for the execution and completion of the work described in the attached plans, specifications, and this agreement. I also agree to do all parts of the contract if it is awarded us, it will be executed in the following manner:

The work shall be commenced at the time stated in notice to Contractor to proceed and shall be completed in the following number of consecutive calendar days from and after the date stated in said notice:

Proposal No. 1	<u>250</u> Days
Proposal No. 2	<u>250</u> Days
Alternate Proposal No. 3	<u>250</u> Days
Combination Proposal No. 4	<u>250</u> Days
Combination Proposal No. 5	<u>250</u> Days

Enclosed herewith is the following security offered as evidence that the undersigned will enter into contract as called for in the attached specifications, Agreement or Contract and Contract Bond.

Certified Check for the sum of \$ 10,000

Name of Bank Seaboard Surety Co.

Bidder's Bond in the amount of \$ 10,000 of base bid

Bond issued by Seaboard Surety Co.

The undersigned further agrees that, in case of failure on his part to execute the said contract and the bond within the ten consecutive calendar days after written notice being given of the award of the contract, the moneys payable by the securities accompanying this bid shall be paid to the Treasurer of the Town of Strasburg, Strasburg, Virginia, as liquidated damages for such failure; otherwise the securities accompanying this proposal shall be returned to the undersigned.

This bid is subject to acceptance within a period of thirty days from this date.

Respectfully submitted,

Date 1/22/44

SEABOARD SURETY CO., Inc.

Contractor

Contractor's Registration No. 103

W.H. Clegg

WILEY & WILSON
CONSULTING ENGINEERS

W. E. WILSON
F. C. WILSON
A. C. WILSON
A. L. WILSON
C. A. WILSON

LYNCHBURG, VA.
THE COURTHOUSE BUILDING
100 EAST MAIN STREET
TELEPHONE 5-5114

RICHMOND, VA.
10 EAST MAIN STREET
TELEPHONE 5-5114

ROANOKE, VA.
10 EAST MAIN STREET
TELEPHONE 5-5114

October 27, 1954

Hon. J. Ray Miller, Mayor
Town of Strasburg
Strasburg, Virginia

Re: Analysis of Bids - Water Works Improvements, Strasburg, Va.

Dear Sir:

In accordance with your instructions, bids were received on Tuesday, October 26, 1954 in your Council Room at 11:00 A.M. for Water Works Improvements, consisting of Division I - Filter Plant Improvements and Division II - Massanutton Mountain Reservoir. The bids received on the filter plant improvements were as follows:

Bickelhaupt, Inc., Richmond, Va. -----	\$52,235.00
Culpeper Building & Supply Corp., Culpeper, Va. --	\$52,853.00
F. L. Showalter, Inc., Lynchburg, Va. -----	\$53,031.00
English Construction Co., Altavista, Va. -----	\$54,400.00
Abbott & Ritchie, Richmond, Va. -----	\$55,742.00

Bids were received from three contractors on Repairs to the Dam, which included raising the dam approximately 5 Ft. together with other improvements. These bids were as follows:

English Construction Co., Altavista, Va. -----	\$55,550.70
F. L. Showalter, Inc., Lynchburg, Va. -----	\$64,120.97
Culpeper Building & Supply Corp., Culpeper, Va. --	\$72,196.20

Additional work of raising the dam was also covered by three proposals as follows:

English Construction Co., Altavista, Va. -----	\$76,088.70
F. L. Showalter, Inc., Lynchburg, Va. -----	\$93,227.95
Culpeper Building & Supply Corp., Culpeper, Va. --	\$99,802.50

It appears that to stay within the available funds, that the repairs to the dam by raising it approximately 5 Ft. offer the best proposal, and the combination bid of English Construction Company in the amount of \$106,000.00 is lower than any other combination for this work.

October 27, 1941.

Dear Sirs: We have had the pleasure of receiving your letter of October 21, 1941, concerning the award of the contract for certain repairs to the dam at the Bond issue. The proposal of the English Construction Company will be accepted at approximately \$106,000 for this work.

While there would be considerable advantage to raising the dam to the maximum height as covered by Combination Proposal No. 5, which includes the filter plant improvements also, the price of \$126,000.00 named by English Construction Company is very attractive. However, this would mean that it would be necessary for you to raise approximately \$10,000.00 additional to carry out this work together with the obligations for engineering, supervision and miscellaneous expenses.

We consider these proposals very satisfactory, as our estimate on the filter plant was \$55,000 and we had hoped to have approximately \$50,000 available for the repairs and improvements to the dam, and the price for Combination Proposal No. 4 by English Construction Company in the amount of \$106,000 very satisfactorily accomplishes the original purpose of the bond issue. It is therefore our recommendation that the contract be awarded to the English Construction Company in the amount of \$106,000 as promptly as possible in order that this work may get under way at the earliest possible date.

As soon as you have awarded contract we will prepare the necessary contracts and notify the contractors that their contract time will begin within ten days from notice from the date on which the award is made.

Yours very truly,

WILLY & WILSON, CONSULTING ENGINEERS

By

W. M. Johnson
W. M. Johnson

WWU-G

Encl.

AGREEMENT OR CONTRACT

This AGREEMENT made and entered into on the 22nd day of November, 1954,

by and between ENGLISH CONSTRUCTION COMPANY, INC., ALTAVISTA, VIRGINIA

party of the first part, and the TOWN OF STRASBURG, STRASBURG, VIRGINIA

party of the second part:

REINAGLETH:

that the first party, for the consideration hereinafter fully set out, hereby agrees with the second party as follows:

(1) That the first party shall furnish all of the materials and perform all of the work in manner and form as provided by the following enumerated plans, specifications and documents, which are attached hereto and made a part hereof, as if fully contained herein:

Advertisement for Bids, Instructions to Bidders, General Conditions, Specifications, Accepted Proposals, together with the Plans Covering all work as called for by "Specifications for Division I - Filter Plant Improvements, and Division II - Massanutton Mountain Reservoir of Water Works Improvements for the Town of Strasburg, Strasburg, Virginia", dated September 15, 1954, together with Addendum No. 1 to Specifications dated October 20, 1954.

(2) That the first party shall commence the work to be performed under this agreement on a date to be specified in a written order of the second party, and shall fully complete all work hereunder within 250 consecutive calendar days from the said date.

(3) The second party hereby agrees to pay to the first party for the faithful performance of the Agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the United States, as follows:

ONE HUNDRED SIX THOUSAND —

DOLLARS (\$ 106,000.00).

which is arrived at as follows:^{*}

(4) Prior to or before the 15th day of each calendar month, the second party shall make partial payments to the first party on the basis of a duly certified and approved estimate of the work performed and materials actually stored on the site, during the preceding calendar month by the first party, less ten per cent (10%) of the amount of such estimate which is to be retained by the second party until all work has been performed strictly in accordance with the Agreement and until such work has been accepted by the second party.

*Combination Proposal No. 4 -- Including Proposal No. 1 for Division No. I - Filter Plant Improvements and Proposal No. 2 for Division No. II - Massanutton Mountain Reservoir Dam Repairs (Items 1 to 17 Inclusive) — \$106,000.00.

APPENDIX VI

DAM MAINTENANCE INSPECTION REPORT

U.S. FOREST SERVICE

- DAM MAINTENANCE INSPECTION REPORT

Ref: FSM 7572.23

1. REGION (1-4) 08	2. FOREST (5-8) 08	3. RANGERDIST. (7-8) 04	4. FOREST INV. NO. (9-12) 2007
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5. NAME OF DAM

Strasburg

BLOCK I - MAINTENANCE INSPECTION CHECKLIST

ITEM (Describe deficient items on attached sheet)	NEEDED REPAIRS (By priority)			ITEM (Describe deficient items on attached sheet)	NEEDED REPAIRS (By priority)		
	1	2	None		1	2	None
1. EMBANKMENTS				4. CLOSED CONDUITS			
a. Slumps, slides		✓		a. Settlement			✓
b. Settlement		✓		b. Displacement			✓
c. Cracks		✓		c. Cracks, spalls <i>water supply line broken</i>	✓	✓	
d. Seepage	✓			d. Seepage			✓
e. Erosion	✓			e. Clogging			✓
f. Slope facing	✓			f. Erosion			✓
g. Debris		✓		g. Corrosion			✓
h. Traffic damage	✓			h. Joints			✓
i. Brush, trees <i>Free alluvium</i>	✓	✓		i. Other			
j. Burrows		✓		5. SPILLWAYS			
k. Other				a. Obstructions			✓
2. CONCRETE STRUCTURES				b. Erosion			✓
a. Settlement		✓		c. Structural			✓
b. Overturning		✓		d. Vegetation			✓
c. Heaving		✓		e. Other			
d. Cracks, spalls		✓		6. DOWNSTREAM CONDITION			
e. Joints		✓		a. Backwater			✓
f. Undermining		✓		b. Erosion			✓
g. Drains		✓		c. Bars, pools			✓
h. Seepage		✓		d. Boils, piping			✓
i. Other		-		e. Other			
3. GATES, CONTROLS				7. RESERVOIR (<i>water is down</i>)			
a. Corrosion		✓		a. Shore erosion			✓
b. Mechanical		✓		b. Debris			✓
c. Structural		✓		c. Sediment			✓
d. Clogging		✓		d. Other			
e. Access		✓		8. OTHER (Identify)			
f. Other				a.			
				b.			
				c.			
				d.			

CARD NO. 12

(OVER)

VI-1

7500-2 (2/69)

BLOCK II - MAINTENANCE COST ESTIMATE

ITEM OF WORK	UNIT	UNIT COST	QUANTITY		COST	
			PRIORITY 1	PRIORITY 2	PRIORITY 1	PRIORITY 2
1(a), (d), 2(f)+(h) Seed & fertilize Front, Top & Back Side of Dam.						
1(i) - Remove all tree & brush on Dam.						
4(c) - Water supply line is broken and out of service						
5(b) + (d) - need to seed & fertilize spillway.						
7(a) - need to seed & fertilize Shore line area.						

TOTALS (Enter in Block III, below)

BLOCK III - SUMMARY MAINTENANCE INSPECTION REPORT

1. DATE OF INSPI. (13 18) NO. DAY YR. 9/2/77	2. HIGHEST PRIORITY CHECKED IN BLOCK I. (19) -	3. EST. MAINT. COST (\$1,000) a. PRIORITY 1 (20 23) --- b. PRIORITY 2 (24 27) ---
4. EST. ENGINEER TIME NEEDED (MAN-HR.) a. PRIORITY 1 (28 30) --- b. PRIORITY 2 (31 33) ---	5. EST. AID & TECH. TIME NEEDED (MAN-HR.) a. PRIORITY 1 (34 36) --- b. PRIORITY 2 (37 39) ---	
6. NOTICE TO OWNER (40) YES - NO -	7. DATE OF NOTICE (41 46) MO. DAY YR. - / - / --	8. LIMITATION (47) YES - NO -
9. TYPE OF LIMITATION (48) -	10. REVISED ESTIMATE OF INSPECTION TIME (MAN-HRS) a. ENGINEER (49-50) b. FOREST OFFICER (51-52) -	c. AID & TECH. (53-54) -

REPORTED BY (Name & signature)

Richard Brown

TITLE

Civil Eng.

DATE

9-26-77

CARD NO. 12